



Docket No.: 1567.1022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re the Application of:

Soo seek CHOI, et al.

Serial No. 10/072,907

Group Art Unit: 1745

Confirmation No. 3556

Filed: February 12, 2002

Examiner: Raymond Alejandro

For: LITHIUM-SULFUR BATTERIES

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GROUP 1700

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RESPONSE TO RESTRICTION REQUIREMENT

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

Sir:

This is responsive to the Office Action mailed October 1, 2003, having a shortened period for response set to expire on November 3, 2003 (November 1 being a Saturday), the following remarks are provided.

I. Provisional Election of Claims Pursuant to 37 CFR §1.142

Applicants provisionally elect Group I, claims 1-17, 38, and 39 in response to the preliminary restriction requirement set forth in the Office Action.

Applicants further provisionally elect Species IC, which the Examiner characterizes as being drawn to a positive electrode having the plasticizer to generate pores. As the Examiner has not set forth which claims recite the plasticizer and in reviewing the elected claims, it is respectfully believed that claims 1-3, 17, 38, and 39 are generic to Species A through C, and claims 1-9, 17, 38, and 39 are generic to Species C. As such, Applicants elect Species C, which includes claims 10-16. Further, since claims 10-16 depend from claim 9, it is respectfully submitted that the election is to claims 1-17, 38, and 39, which includes Species C and claims generic thereto.

II. Applicants Traverse the Requirement

A. Group I and II

Insofar as Groups I and II are concerned, it is believed that claims 18-28 of Group II are so closely related to elected claims 1-17, 38, and 39 of Group I that they should remain in the

same application. The elected claims 1-17, 38, and 39 are directed to a lithium-sulfur battery, with at least depending claim 4 reciting the structure of the positive electrode provided by "mixing an elemental sulfur ( $S_8$ ) powder, a conductive agent, and a binder to provide a positive active material slurry" and "coating the positive active material slurry on a current collector." Claims 18-28 are drawn to a method of preparing a positive electrode, where at least claim 18 recites "mixing an elemental sulfur ( $S_8$ ) powder, a conductive agent, and a binder to provide a positive active material slurry; and coating the positive active material slurry on a current collector, wherein, during an electrochemical reaction, an active sulfur from the elemental sulfur powder is disposed in pores on the current collector, and the pores have an average size of up to 20  $\mu m$  and are both electron-conductive and ion-conductive."

There have been no references cited to show any necessity for requiring restriction and, in fact, it is believed that the Examiner would find references containing both method and product claims in the same field of technology. While it is noted that the Examiner has identified different classifications for the product and method claims, it is believed that classification is not conclusive on the question of restriction. It is believed, moreover, that evaluation of both sets of claims would not provide an undue burden upon the Examiner at this time in comparison with the additional expense and delay to Applicants in having to protect the additional subject matter recited by the Group II claims by filing a divisional application.

MPEP §803 sets forth the criteria for restriction between patentably distinct inventions. (A) indicates that the inventions must be independent (see MPEP §802.01, §806.04, §808.01) or distinct as claimed (see MPEP §806.05-806.05(i)); and (B) indicates that there must be a serious burden on the Examiner if restriction is required (see MPEP §803.02, §806.04(a)-§806.04(i), §808.01(a) and §808.02). As such, beyond showing separate classifications, it is respectfully submitted that the Examiner has not set forth sufficient evidence to show that the Examiner will experience a serious burden in examining claims of Groups I and II, without imposing restriction, which is out of proportion with the serious burden and inconvenience visited upon the applicant if restriction is required. Therefore, it is respectfully submitted that the Examiner has not provided sufficient evidence of an undue burden on the Examiner to maintain a restriction requirement as between the claims of Groups I and II.

B. Group I and III

As an initial point of clarification, the Examiner asserts that claims 1-17, 38, and 39 of Group I are drawn to a lithium-sulfur battery which does not require the use of the specific positive electrode, whereas claims 29-37 of Group III are drawn to a positive electrode

comprising a current collector. As evidence, the Examiner asserts that the battery of claims 1-17, 38, and 39 recite a positive electrode that can include any electrochemically active material or that the positive electrode comprises the conductive agent and a binder themselves, or that the positive electrode comprises a substrate or a current collector. However, while the Examiner may be correct as to the features which may or may not be used with the lithium battery, the Examiner's assertions do not appear to accurately reflect the invention as claimed.

By way of review, claim 1 recites a "lithium-sulfur battery comprising: a positive electrode having an electron-conductive path and an ion-conductive path and comprising: a positive active material including an active sulfur, and pores of an average size of up to 20  $\mu\text{m}$  having both electron-conductive and ion-conductive properties, where the active sulfur is disposed in the pores during an electrochemical reaction of the lithium-sulfur battery; a negative electrode comprising a negative active material selected from the group consisting of a lithium metal, a lithium-containing alloy, materials which can reversibly intercalate/deintercalate lithium ions, or materials which can reversibly form a chemical compound with lithium; a separator interposed between said positive and negative electrodes; and an ion-conductive electrolyte." As such, claim 1 does not recite the limitations as set forth by the Examiner.

Further, at least claim 4 recites a "current collector," but does not recite a current collector or a substrate as set forth by the Examiner.

Moreover, claim 29 recites "a positive active material including an active sulfur; and a current collector coated with the positive active material and, during an electrochemical reaction of the lithium-sulfur battery, has pores of an average size of up to 20  $\mu\text{m}$  in which the active sulfur is disposed and having both electron-conductive and ion-conductive properties, wherein the positive electrode has an electron-conductive path and an ion-conductive path."

As noted in MPEP 806.05(c), a combination and a subcombination may be different inventions where "it can be shown that a combination *as claimed*: (A) does not require the particulars of the subcombination as claimed for patentability (to show novelty and unobviousness), and (B) the subcombination can be shown to have utility either by itself or in other and different relations" (*italics added*). As such, the focus in determining whether the combination is different from a subcombination is based upon the claimed invention. As claims 1 recites the use of "a positive active material including an active sulfur, and pores of an average size of up to 20  $\mu\text{m}$  having both electron-conductive and ion-conductive properties, where the active sulfur is disposed in the pores during an electrochemical reaction of the lithium-sulfur battery," and claim 29 recites "a positive active material including an active sulfur; and a current

collector coated with the positive active material and, during an electrochemical reaction of the lithium-sulfur battery, has pores of an average size of up to 20  $\mu\text{m}$  in which the active sulfur is disposed and having both electron-conductive and ion-conductive properties, wherein the positive electrode has an electron-conductive path and an ion-conductive path" it is respectfully submitted that the Examiner has not analyzed the invention of Group I to determine if, as *claimed*, the lithium sulfur battery having the recited positive electrode of Group I is separately usable from the invention of Group III, which the Examiner characterizes as being drawn to a positive electrode having an electrode chemical feature separately usable from the lithium sulfur battery having the positive electrode recited in claim 1. Therefore, it is respectfully submitted that the Examiner has not set forth sufficient evidence that the invention as claimed in claims 1-17, 38, and 39 is separately usable from the invention as claimed in claims 29-37 as is required to maintain a prima facie restriction requirement under the two way standard set forth for combination/sub-combinations in at least MPEP 806.05(c). Therefore, it is respectfully requested that the Examiner reconsider and withdraw the restriction as between Groups I and III.

C. Non Elected Groups II and III

Insofar as Groups II and III are concerned, it is believed that claims 18-28 are so closely related to non-elected claims 29-37 that, should either Group II or Group III remain in the application, both Group II and Group III should remain in the same application. Moreover, while the Examiner asserts various "admissions" on page 3 of the Office Action, it is respectfully submitted that the "admissions" are not in correspondence with the invention as claimed. Specifically, claims 29-37 of Group III are directed to a positive electrode for use in a lithium-sulfur battery. In contrast and as also described above in Section A, claims 18-28 are drawn to a method of preparing a positive electrode, where at least claim 18 recites "mixing an elemental sulfur ( $\text{S}_8$ ) powder, a conductive agent, and a binder to provide a positive active material slurry; and coating the positive active material slurry on a current collector, wherein, during an electrochemical reaction, an active sulfur from the elemental sulfur powder is disposed in pores on the current collector, and the pores have an average size of up to 20  $\mu\text{m}$  and are both electron-conductive and ion-conductive."

There have again been no references cited to show any necessity for requiring restriction and, in fact, it is believed that the Examiner would find references containing both method and product claims in the same field of technology. While it is noted that the Examiner has identified different classifications for the product and method claims, it is again believed that classification

is not conclusive on the question of restriction. It is believed, moreover, that evaluation of both sets of claims would not provide an undue burden upon the Examiner at this time in comparison with the additional expense and delay to Applicants in having to protect the additional subject matter recited by the Group III or Group II claims by filing a divisional application(s).

As such, beyond showing separate classifications, it is respectfully submitted that the Examiner has not set forth sufficient evidence to show that the Examiner will experience a serious burden without imposing restriction which is out of proportion with the serious burden and inconvenience visited upon the applicant if restriction is required.

D. Election as to Species

On pages 4-5, the Examiner asserts that applicants must elect between species drawn to a positive electrode having an active sulfur only (Species IA), a positive electrode having a current collector (Species IB), and a positive electrode including a plasticizer to generate pores on the current collector (Species IC). The Examiner further asserts that no claims are generic.

By way of review, claim 1 recites, among other features, "a positive electrode having an electron-conductive path and an ion-conductive path and comprising: a positive active material including an active sulfur, and pores of an average size of up to 20  $\mu\text{m}$  having both electron-conductive and ion-conductive properties, where the active sulfur is disposed in the pores during an electrochemical reaction of the lithium-sulfur battery." As such, claim 1 recites both the positive active material, and the use of pores. As claim 1 recites that the positive electrode comprises the positive active material, indicating through the open-ended transitional term "comprising" that additional features are covered by the recited positive electrode, and does not restrict a mechanism by which the pores are constructed. MPEP 2111.03. Therefore, claim 1 is generic to Species A through C.

For similar reasons, claims 2, 3, 17, 38, and 39 are also generic to Species A through C.

Additionally, claims 4-16 depend from claim 1 such that claim 1 is generic to claims 4-16 due at least to their depending from claim 1. Also, claims 10-16 depend from claim 9 such that claims 1, 4, and 9 are generic to claims 10-16. As such, for claims 10-16, which depend from claim 9 and appear directed to the use of a plasticizer consistent with the Examiner's definition of Species IC, claims 1-9, 17, 38, and 39 are generic to Species IC.

Moreover, the Examiner has not provided evidence that the Examiner will experience an undue burden in searching and examining the invention set forth in Species IA through IC. Specifically, the Examiner has not provided evidence that the existence of three species

represents an unreasonable number of species to be searched, and has not provided a rationale as to why the invention is to be separated into Species IA through IC. In contrast and consistent with the requirements in MPEP 803 and 808, the Examiner needs to provide a rationale as to why an election is required or how, without the election, the Examiner is unduly burdened in comparison with the burden visited on the applicants in the extra delay and expense in obtaining protection for each Species. The Examiner has not provided such a rationale in the Office Action utilizing the factors set forth in MPEP 803.

It is further respectfully believed that, especially in view of the fact that the claims of Species IC depend from parent claims belonging to Species IA and IB, in searching the technologies related to the Species IC, the Examiner will encounter a positive electrode having the features of Species IA and IB.

As such, it is respectfully submitted that the Examiner has not presented sufficient evidence of a burden on the Examiner in examining Species IA through IC which is out of proportion with the delay and expense visited on the applicants in protecting the invention recited in Species IA and IB so as to show an undue burden on the Examiner sufficient to require an election between these species.

For similar reasons, it is respectfully submitted that, in addition to the generic nature of claims 18-22 to Species IIA and IIB and claims 29-31 being generic to Species IIIA and IIIB, it is respectfully submitted that the Examiner has not provided a sufficient rationale or other evidence as is required to show that, without restriction, the Examiner will experience a burden that is undue in comparison to the burden on the applicants in the delay and expense of obtaining protection for these remaining Species so as to require an election between these species.

As such, it is respectfully submitted that the Examiner has not provided sufficient evidence to maintain a prima facie requirement for an election between Species for the Group I through III claims.

### III. Conclusion

Upon review of references involved in this field of technology and when all of the other various facts are taken into consideration, it is believed that upon reconsideration of the Examiner's initial restriction requirement, all of the pending claims should be examined in the subject application.

If any further fees are required in connection with the filing of this Response, please charge the same to our deposit account number 19-3935.

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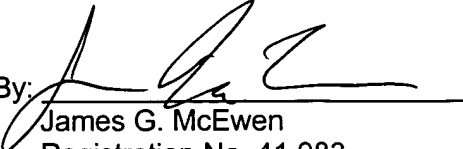
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Should any questions remain unresolved, the Examiner is requested to telephone Applicants' attorney.

Respectfully submitted,

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